[Document Name]Description

[Title of the Invention]Video encoding method

[Claim(s)]

[Claim 1]A coded image in a frame which divides every frame into a block of a predetermined unit which consists of two or more pixels of an inputted digital video signal, and performs only orthogonal-transformation coding for a video signal of said block.
An inter-frame coded image which moves for every at least 1-block unit, performs compensation prediction, and performs orthogonal-transformation coding for said every block unit to a prediction error to generate.
A quantization judging level which is the video encoding method provided with the above, and sets a quantization value of an orthogonal-transformation coefficient to a motion compensation prediction error of a picture from said inter-frame encoding means to "0" is changed by a statistics value in a picture and between a picture.

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the video data-compression-coding method for storing and transmitting the digitized video data.

[0002]

[Description of the Prior Art]The coded image in a frame in which the digitized input video is divided into the block which consists of two or more pixels, and performs orthogonal-transformation coding directly for every block in the conventional motion compensation inter-frame coding, It comprises an inter-frame coded image which moves per two or more blocks, performs compensation prediction, and performs orthogonal-transformation coding to this prediction error. That is, as shown in drawing 6, it is made the form which the coded image I in a frame inserts into two or

more inter-frame coded images P and B.

[0003]The unit of two or more frames until the coded image in this frame is generated is called GroupOfPicture (GOP). Here, as for Intra Coded Picture and P, Predictive Coded Picture and B of I are Bi-directional Predictive Coded Picture.

[0004]As shown in drawing 7, the quantization method used by said orthogonal-transformation coding is alignment quantization using the quantization step width which carried out the multiplication of the quantization scale which is a parameter of the quantization matrix set up beforehand and bit rate control, and generated it. However, the quantization characteristics in the time of the coding in a frame and inter-frame coding differ, and the latter is larger than the case where the quantization judging level which sets a quantization value to "0" is the former. This is raising coding efficiency. The field of the quantization judging level which sets said quantization value to "0" here is called the "Dead Zone."

[0005]By these quantization methods, variable-length numerals are assigned, and it is accumulated in a transmission buffer with information, including a quantization scale or a motion vector, and is transmitted to the quantization value of the quantized conversion factor by the fixed bit rate. The amount of generating numerals is kept almost constant by changing said quantization scale and controlling quantization by the amount of numerals accumulated in the buffer.

[0006]JP,H3-243086,A is performing the amount control of numerals which carries out suitable to input video because not only the amount of numerals accumulated in the transmission buffer but a motion compensation prediction error uses as a parameter the above-mentioned quantization scale for which the amount of generating numerals is controlled.

[0007]

[Problem to be solved by the invention]However, in the video encoding method mentioned above, it was change of only the quantization step width accompanying a quantization scale, and the width of said Dead Zone was only twice [quantization scale] the preset value. Therefore, the fault that the optimal coding efficiency is not acquired depending on an input picture occurs, making the setting Dead Zone fixation. Then, an object of this invention is to provide the efficient video encoding method which carried out suitable to input video.

[0008]

[Means for solving problem]In the video encoding method which is characterized by comprising the following in order that this invention may attain said purpose, The video encoding method which changes the quantization judging level which sets the

quantization value of the orthogonal-transformation coefficient to the motion compensation prediction error of the picture from said inter-frame encoding means to "0" by the statistics value in a picture and between a picture.
The coded image in a frame which divides every frame into the block of the predetermined unit which consists of two or more pixels of the inputted digital video signal, and performs only orthogonal-transformation coding for the video signal of said block.
The inter-frame coded image which moves for every at least 1-block unit, performs compensation prediction, and performs orthogonal-transformation coding for said every block unit to the prediction error to generate.

[0009]Quantization is performed by the quantization step width generated by carrying out the multiplication of the quantization scale to the quantization matrix by which initial setting was carried out to the orthogonal-transformation coefficient in said orthogonal-transformation coding, Assign variable-length numerals to this quantization value, and, [said statistics value] It is considered as the product of the amount of generating numerals of one frame, and alpha ** of an average quantization scale, and the video encoding method which changes the quantization judging level which sets the quantization value at the time of said inter-frame coding to "0" using the ratio of this statistics value of the coded image in a frame and an inter-frame picture is provided.

[0010]

[Function]The correlativity of the direction of space whose above video encoding methods of composition are the character of an input picture, It is obtained by calculating a statistics value [as opposed to the motion compensation prediction error of the statistics value of the pixel in the coded image in a frame, and an inter-frame coded image for the correlativity of the direction of time], The amount of generating numerals between the coded image in a frame and an inter-frame coded image is controlled by controlling the width of the Dead Zone of the quantization at the time of inter-frame coding by the ratio of these statistics values, and the coding which is suitable for character at an input picture is performed.

[0011]

[Working example]Hereafter, with reference to Drawings, the embodiment of this invention is described in detail.

[0012]The composition of the video encoding method as the 1st embodiment by this invention is shown and explained to drawing 1. In this method, although Image Processing Division of the digitized video data to input is carried out on the basis of the inside of a frame or the field (between) (between), since it is simplification of explanation, the inside of a frame (between) is explained here. An operation of this invention is not limited in said frame (between), and its inside of the field (between) is also equivalent.

[0013]In this video encoding method, the video data digitized from the input terminal 1 is inputted into the subtraction machine 2, the switch 3, or the motion compensation prediction machine (MC) 4 for every macroblock unit shown in drawing 2.

[0014]A certain motion compensation prediction macroblock outputted from said motion compensation prediction machine (MC) 4 goes into said subtraction machine 2 as another input of this subtraction machine 2, and is subtracted between the original picture macroblocks extracted from said original picture image. Thereby, a prediction error macroblock is generated and it is inputted into said switch 3.

[0015]As for said switch 3, an original picture macroblock and a prediction error macroblock are switched accommodative by the control signal of frame inner and the inter-frame judgment part 5. Here, in said frame inner and inter-frame judgment part 5, statistics values, such as distribution in an original picture macroblock and a prediction error macroblock, are computed, and the control signal is outputted so that the one where the quantity is smaller may be chosen with said switch 3 and the switch 6.

[0016]An original picture macroblock or a prediction error macroblock selected with this switch 6 is inputted into DCT7. Here, a macroblock is further extracted per block (for example, 8x8 pixels), and a discrete cosine transform is carried out to this block unit. The conversion factor which is the conversion result goes into the quantization machine (Q) 8, and receives an original picture macroblock or a prediction error macroblock from said frame inner and inter-frame judgment part 5, and quantization of the respectively different quantization characteristic as shown in drawing 7 is performed. The variable-length numerals which these quantization values are inputted into the variable-length-coding machine (VLC) 9, and correspond are assigned, and it is outputted to the multiplexer 10.

[0017]Here, the quantization scale outputted from the quantization scale control part 12 into which the amount of occupancy of the transmission buffer 11 is inputted is inputted into said quantization machine (Q) 8, multiplication is carried out to the quantization matrix set up beforehand, and quantization step width is generated. Alignment quantization is performed by this step width.

[0018]In the Dead Zone control part 13, the amount of generating numerals from the quantization scale which is an output from said quantization scale control part 12, and said variable-length-coding machine (VLC) 9 is inputted, The control signal for controlling the Dead Zone of quantization of inter-frame coding from these information is inputted into said quantization machine (Q) 8 and the dequantization machine (Q^{-1}) 14. Thereby, a change of the Dead Zone is made.

[0019]The concrete composition of said Dead Zone control part 13 is shown and explained to drawing 3 here. The quantization scale outputted from said quantization scale control part 12 is x(an average of Q scales) alpha multiplication appearance part 21, and alpha ** of average quantization scale A_Q in one in one frame is computed. Here, alpha is a constant. The amount of generating numerals from the variable-length-coding machine (VLC) 9 is inputted into the total amount calculation

part 22 of numerals, and the total amount C of numerals in one frame is computed. PARARUTA which shows the characteristic of a picture is generated by carrying out the multiplication of these two quantity with the multiplier 23.

[0020]The case where this characteristic parameter is a coded image in a frame is made into $A_O$xalpha ** (I)xC(I), the case where it is an inter-frame coded image is set to $A_O$xalpha ** (P) xC (P), and these ratios are computed by the Dead Zone change parameter generation part 24. Said I and O are the same meaning as what was shown in said drawing 6 here, and I Intra Coded Picture, P is Predictive Coded Picture and B is an initial of Bi-directional Predictive Coded Picture. This Dead Zone change parameter is inputted into the table 25 corresponding to the Dead Zone, the width of the Dead Zone corresponding to this parameter is chosen, and it is outputted to the quantization machine (Q) 8 and the dequantization machine (Q^{-1}) 14 which are shown in drawing 1.

[0021]Change of the Dead Zone mentioned above performs GOP as shown in drawing 6 as a unit, and writes in the contents corresponding to the Dead Zone changed into the head of each GOP as side information. However, GOP shown in drawing 6 is only an example, and, as for the frame composition of GOP, at least one or more coded image (I)s in a frame should be just contained.

[0022]It returns to drawing 1, and dequantization of the output from said quantization machine (Q) 8 is carried out with the dequantization machine (Q^{-1}) 14, and it is returned to a conversion factor value. And in the reverse dispersion cosine transform machine (IDCT) 15, the inputted conversion factor value is restored to an original picture macroblock or a prediction error macroblock, and it is inputted into the adding machine 16.

[0023]In said motion compensation prediction machine (MC) 4, it moves per macroblock between the reference picture and input original picture image which were stored in the buffer in this, and is detected between, and the motion compensation prediction macroblock by which motion compensation was carried out is generated based on this motion vector. This data is inputted into said switch 6 and said subtraction machine 3. With said switch 6, it is chosen in a frame by the control signal which the inter-frame judgment part 5 outputted whether motion compensation prediction macroblock data is inputted into the adding machine 16.

[0024]In said adding machine 16, the output from said IDCT15, and an aggregate value with said prediction macroblock or the output from said IDCT15 is outputted directly. This output data is the macroblock by which local decoding was carried out, it moves in addition to an inter-frame coded image (B), is accumulated in the buffer memory in the compensation prediction machine (MC) 4, and serves as a reference image for motion compensation of the frame coded next.

[0025]The motion vector information outputted from said motion compensation prediction machine (MC) 4 goes into the multiplexer 10, the change Dead Zone information which is an output from the quantization scale which is an output from

said quantization scale control part 12, and said Dead Zone control part 13. Output data is switched so that the variable-length numerals which are the outputs from said variable-length-coding machine (VLC) 9 may input into this multiplexer 10 and it may become the decided bit sequence, and it is stored in said transmission buffer 11. The above processing is repeated and the inputted video data is coded.

[0026]In the embodiment mentioned above, since the character (correlativity of space and the direction of time) of input video is searched for in time with the amount of numerals and average quantization scale of the coded image in a frame in front of one, and the inter-frame coded image in order to change the Dead Zone, it can carry out easily.

[0027]Next, the composition of the video encoding method as the 2nd embodiment by this invention is shown and explained to drawing 4. Here, in the 2nd embodiment, explanation shall be omitted about a member equivalent to the 1st embodiment, and only a characterizing portion shall be explained.

[0028]First, a statistics value (here, it is considered as a distributed value.) in an original picture macroblock computed and a prediction error macroblock is inputted into the Dead Zone control part 31 within frame inner and the inter-frame judgment part 32. The Dead Zone of quantization of inter-frame coding of GOP as shown in drawing 6 in a unit is changed like the 1st embodiment using these two statistics values. Concrete composition of said Dead Zone control part 31 is shown in drawing 5, and is explained here.

[0029]The frame Uchihira [Hitoshi] statistics value calculation part 41 and a prediction error macroblock internal variance value are inputted into the inter-frame average statistics value calculation part 42 for an original picture macroblock internal variance value inputted from said frame inner and inter-frame judgment part 31, data for one frame is added, and average value is obtained. These values correspond to correlation of the direction of space, and correlation of the direction of time, respectively. In the Dead Zone change parameter generation part 43, said two average value is inputted, and these ratios are computed, and let this ratio be the Dead Zone change parameter. This called-for parameter goes into the table 44 corresponding to the Dead Zone, and the Dead Zone width corresponding to this parameter is outputted. This Dead Zone width is outputted only at the beginning of GOP, and changes the Dead Zone of quantization at the time of inter-frame coding of the quantization machine (Q) 8 shown in drawing 4, and the dequantization machine (Q^{-1}) 14. A thing to a frame of the last of GOP in front of one is used for data used for parameter calculation at that time.

[0030]In this 2nd embodiment, since the character (correlativity of space and the direction of time) of the input video for changing the Dead Zone is generated using the amount of judgments which can be calculated in the frame of a macroblock unit at the time of an inter-frame judging, it is realizable by the increase in few processing members. Although said embodiment was description by coding of a frame unit, even when switching a frame and the field for the field also as a unit, it can perform same processing.

[0031]As explained above, [the video encoding method of this example] When the quantization value of the quantization used for inter-frame (between the fields) coding with the character of input video changes the quantization judging level (Dead Zone) used as "0", Suitable [of the amount of generating numerals of a coded image and an inter-frame (between the fields) coded image] is carried out more in a frame (inside of the field), and efficient compression is realized. As for this invention, it is needless to say for various modification and application to be possible in the range which is not limited to the embodiment mentioned above and does not deviate from the gist of an invention to others.

[0032]

[Effect of the Invention]As explained in full detail above, according to this invention, the efficient video encoding method which carried out suitable to input video can be provided.

[Brief Description of the Drawings]

[Drawing 1]Drawing 1 shows and explains the composition of the video encoding method as the 1st embodiment by this invention.

[Drawing 2]Drawing 2 is a figure showing the composition of a macroblock unit.

[Drawing 3]Drawing 3 is a figure showing the concrete composition of the Dead Zone control part shown in drawing 1.

[Drawing 4]Drawing 4 is a figure showing the composition of the video encoding method as the 2nd embodiment by this invention.

[Drawing 5]Drawing 5 is a figure showing the concrete composition of the Dead Zone control part shown in drawing 4.

[Drawing 6]Drawing 6 is a figure showing the composition of the block division used for motion compensation inter-frame coding.

[Drawing 7]Drawing 7 is a figure showing the composition of the quantization scale used by orthogonal-transformation coding.

[Explanations of letters or numerals]1 [-- Motion compensation prediction machine (MC),] -- An input terminal, 2 -- A subtraction machine, 3, 6 -- A switch, 4 5, 32 -- Frame inner and an inter-frame judgment part, 7 -- DCT7, 8 -- Quantization machine (Q), 9 -- A variable-length-coding machine (VLC), 10 -- A multiplexer, 11 --

Transmission buffer, 12 -- A quantization scale control part, 13, 31 -- The Dead Zone control part, 14 -- Dequantization machine (Q^{-1}), 15 -- A reverse dispersion cosine transform machine (IDCT), 16 -- An adding machine, 17 -- (an average of Q scales) xalpha multiplication appearance part, 22 [-- A frame Uchihira / Hitoshi / statistics value calculation part, 42 / -- An inter-frame average statistics value calculation part, 43 / -- The Dead Zone change parameter generation part, 44 / -- Table corresponding to the Dead Zone.] -- The total amount calculation part of numerals, 23 -- A multiplier, 24 -- The Dead Zone change parameter generation part, 41

[Translation done.]